

# **GD-095-PHS-EMS: Curriculum for Continuous Positive Airway Pressure (CPAP) Training**

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## **STATE OF ARIZONA • EMERGENCY MEDICAL SERVICES AND TRAUMA SYSTEM**

### **Curriculum for Non-Invasive Ventilatory Support**

#### **Continuous Positive Airway Pressure (CPAP)**

#### **Course Description**

This course is designed to provide instruction in a procedure for the use of the Continuous Positive Airway Pressure Device (CPAP) by the EMT-P who is approved by an administrative medical director to perform the procedure.

#### **Prerequisites**

1. The EMT must be a certified Paramedic with the approval of the administrative medical director.

#### **Methodology**

This guidance document suggests the following didactic, psychomotor, written and practical evaluation, and remediation process to ensure proficiency.

The following is a breakdown of the following recommended minimum hours for training:

- 1 ½ hours– Didactic/lecture
- ½ hour- Psychomotor/hand-on practice
- ½ hour – Written and skills remediation
- ½ hour – Remediation

#### **Instructor**

The instructor must be approved by the administrative medical director and meet the following requirements:

- a. Would qualify, under A.A.C. R9-25-312(D), to serve as a preceptor for a course at the level of EMT certification held by the EMT; and
- b. Is authorized to perform the supplemental skill.

#### **Equipment**

The following equipment is required for the course:

- Body Substance Isolation (BSI) equipment
- Pulse Oximeter
- CPAP Machine with Accessories
- Oxygen Cylinder
- Suction Equipment
- BVM
- ETCO2 Monitor (Optional)

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### **Course Competencies:**

Upon completion of the course, the student shall be able to:

1. List the indications, contraindications, advantages, and potential complications with the use of CPAP.
2. Identify the equipment required for use of CPAP.
3. Describe and demonstrate Body Substance Isolation (BSI) procedures required for use with CPAP.
4. Describe and demonstrate respiratory assessment and basic airway management techniques.
5. Describe and demonstrate procedures, including preparation of equipment, positioning the patient, for use of CPAP.
6. Demonstrate proper utilization of CPAP device to include:
  - a) Properly sized mask and positioning of mask to include utilization of head straps.
  - b) Titration of PEEP
  - c) Coaching of Patient
  - d) Monitoring of CPAP circuit for air leaks.
  - e) Monitoring the face mask placement for proper fit
  - f) Monitoring the patient's response and tolerance to the CPAP
  - g) Administration of Medications as appropriate
7. Describe and demonstrate documentation of the CPAP procedures and patient assessment.
8. Discuss the role of medical direction and oversight in the use of the CPAP.
9. Describe the refresher training necessary to maintain authorization to use CPAP.
10. Complete a written and practical skills evaluation with 80% competency; no failure of critical criteria.

**COURSE OUTLINE**

**Module One: Lecture**

**I. Purpose and Description**

**A. Purpose:**

CPAP is a non-invasive means of providing respiratory support for patients who are in enough distress that they need more than supplemental oxygen, but do not yet require intubation. By providing a continuous level of pressure to the lungs through an airtight mask, CPAP has been shown to decrease or delay the need for intubation both in the hospital and in the field. In early published and unpublished studies, CPAP used in the hospital and prehospital settings showed more rapid improvement of vital signs (heart rate, respiratory rate, blood pressure) and oxygen saturation versus standard medical therapy alone in pulmonary edema patients.

**B. Description:**

CPAP devices deliver continuous positive airway pressure and operator adjustable levels throughout the breathing cycle independent of the patient's flow requirements which assists overcoming airway resistance, keeps alveoli open and improves pulmonary gas exchange in patients with respiratory compromise. Positive pressure ventilation also decreases blood return to the heart and may lower blood pressure.

**II. Respiratory Anatomy and Physiology**

**A. Anatomy**

1. Nose
2. Nasal Air Passages
3. Mouth
4. Pharynx
5. Glottis
6. Trachea
7. Bronchi
8. Bronchioles, and Alveoli

**B. Physiology**

1. Pressure changes and ventilation
2. Muscles of respiration
  - a. Compliance
3. Lung volumes and capacities
  - a. Tidal volume
  - b. Inspiratory reserve volume
  - c. Maximum respiration
  - d. Expiratory reserve volume
  - e. Maximum expiration
  - f. Total lung capacity
  - g. Inspiratory capacity
  - h. Functional reserve capacity
  - i. Vital capacity
  - j. Minute volume

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4. Exchange and transport of gases in the body
  - a. Diffusion
  - b. Oxygen content of blood
  - c. Carbon dioxide content of blood
  - d. Chemical control of respiration
  - e. Control of respiration by other factors
    - 1) Body temperature
    - 2) Drugs and medications
    - 3) Pain
    - 4) Emotion
    - 5) Sleep

### **III. Respiratory Assessment**

#### **A. Respiratory Assessment**

1. LOOK
  - a. Adequate, Equal Expansion of Chest
  - b. Skin Color (cyanosis)
2. LISTEN
  - a. Unusual sounds
  - b. Crowing, gasping, gurgling, wheezing
  - c. Breath sounds
    - 1) Present
    - 2) Equal
3. FEEL
  - a. Air movement at mouth/nose
4. SIGNS OF RESPIRATORY FAILURE
  - a. LOOK
    - 1) Anxious or comatose
    - 2) Absent, minimal or uneven Chest Rise
    - 3) Cyanosis
    - 4) “Abdominal breathing”
    - 5) Breathing rate is too rapid or too slow
    - 6) Retractions
    - 7) Nasal Flaring
  - b. LISTEN
    - 1) Gurgling, Stridor, Crowing, Snoring
    - 2) Wheezing
    - 3) Speaks in short sentences
    - 4) May be Unable to Speak
  - c. FEEL
    - 1) Diaphoretic
    - 2) Diminished or absent air movement

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- IV. Review of Disease Processes & Conditions Where CPAP is Indicated:
- A. Congestive Heart Failure (CHF)
  - B. Pulmonary Edema
  - C. COPD
  - D. Asthma
  - E. Pneumonia
- V. Indications:
- A. Patients over 10 years of age presenting in acute respiratory distress who are able to follow commands and maintain a patent airway who display findings of any of the following conditions:
    1. CHF
    2. Pulmonary edema
    3. Asthma/COPD
    4. Submersion/drowning or smoke inhalation
    5. Pneumonia
- AND meets two or more of the following criteria*
- Respiratory rate > 24/minute
  - Notable increased work of breathing
  - SpO<sub>2</sub> < 92% at any time
  - Skin mottling, pallor or cyanosis suggesting hypoxia
  - Presence of abnormal breath sounds or frothy sputum
- VI. Contraindications:
- A. Patients less than 10 years of age
  - B. Unconsciousness or GCS < 12
  - C. SBP < 90
  - D. Respiratory arrest/agonal respirations
  - E. Blunt/penetrating chest trauma/suspected pneumothorax
  - F. Facial trauma/deformity/burns inhibiting proper mask fit
  - G. Recent facial or gastric surgery
  - H. High risk of aspiration/active vomiting
  - I. Tracheostomy
  - J. Pneumothorax
- VII. Special Considerations
- A. CPAP should be discontinued in the case of patient non-tolerance or progression to respiratory failure
  - B. CPAP should not delay the administration of medications, e.g., nitro, albuterol, etc.
  - C. Advise the receiving facility of initiation of CPAP therapy as soon as practical
  - D. Observe patient for signs/symptoms of hypotension, respiratory failure or gastric distension
  - E. **DNR is not a contraindication to CPAP use**

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### **VIII. Advantages**

- A. Provides positive pressure ventilation without the need for intubation
- B. Permits adequate oxygenation with lower FIO<sub>2</sub>
- C. Avoidance of risk, complications, and expense of ET intubation
- D. Decreases the need for sedation/paralytics
- E. Decreases the risk of nasocomial infections
- F. Preservation of speech
- G. Patient can swallow, eat and drink
- H. Preservation of normal airway defense mechanisms
- I. In COPD patients may reduce the need for ETT in as much as 80% of patients
- J. Nasal mask CPAP has been shown effective in elderly patients with acute respiratory failure to avoid intubation

### **IX. Complications**

- A. Heightened sense of claustrophobia or smothering
- B. Abrasions to the bridge of the nose
- C. Significant mask leak may lead to rapid life threatening hypoxemia
- D. Patient discomfort
- E. Loss of definitive control of airway and breathing
- F. Aerophagia (less common)
- G. Impaired access to airway for suctioning (less common)
- H. Facial skin pressure stress (long term use)
- I. High external pressures may increase intrathoracic pressures thus decreasing venous return and decreasing cardiac output (rare complication)
- J. Potential for barotraumas —pneumothorax or pneumomediastinum (rare complication)
- K. Potential for aspiration, gastric distention and inability to clear secretions (rare complication)

### **X. Limitations**

- A. Intermittent use of diuretics is required in CHF patients
- B. Positive pressure ventilation can only decrease consequences of hypoxemia and decrease need of high concentration of O<sub>2</sub>. It does not preclude poor outcomes due to other systemic disturbances
- C. Only an alternative to standard mechanical ventilation system

### **XI. Precautions**

- A. Mechanical ventilation and intubation remain the mainstay of treatment for patient with persistent hypoxia or respiratory muscle fatigue
- B. Intubation should be available for patients who do not respond to non-invasive positive pressure ventilation

### **XII. Procedure:**

- A. Demonstrate Body Substance Isolation (BSI) procedures.
- B. Assemble and prepare the equipment.
  - 1. Prepare CPAP equipment and adequate oxygen supply
  - 2. Explain the CPAP procedure to the patient
  - 3. Place the patient in a high fowler's position
  - 4. Place EKG monitor
  - 5. Place SPO<sub>2</sub> monitoring device

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6. Place ETCO<sub>2</sub> detector on face if available, get initial reading
7. Check CPAP for oxygen flow, dial up for flow, then turn off
8. Have patient hold CPAP mask in proper position with proper force
9. Dial up to a PEEP starting at 5 cm H<sub>2</sub>O
10. Coach the patient how to breathe and to relax
  - Use verbal sedation, coach the patient throughout the transport
  - You are going to feel better from the pressure of the mask
  - Breathe in slowly through your nose
  - Exhale slowly through your mouth
  - Medic counts aloud 1,2,3,4 during patients exhalation
11. Place the head straps if patient will allow them to be used
12. Monitor the CPAP circuit for air leaks
13. Monitor the face mask placement for proper fit
14. Monitor the patient's respiratory response to the CPAP
15. Slowly titrate the PEEP up to 10 cm H<sub>2</sub>O as needed, and monitor the patient's tolerance
16. Monitor and record the patient's vitals signs every 5 minutes
17. Titrate the PEEP down to 5 cm H<sub>2</sub>O if the BP < 90 Systolic
18. Administer medications as appropriate per patient condition (i.e. administration of Albuterol/Atrovent medication using the SVN inline configuration, Nitro tablets as indicated, BP > 100 Systolic)
19. Monitor for gastric distention
20. Notify receiving facility and advise that CPAP is in use, have CPAP at bedside

### C. Special Notes

#### **Remove the CPAP if the following situations occur:**

- The patient level of consciousness deteriorates, cannot follow commands.
- The patient becomes unresponsive.
- The patient's respiratory status declines, cannot maintain airway.
- The patient degrades to agonal respiratory effort or apnea.
- The patient develops active vomiting.
- The patient develops active upper GI bleeding.
- The patient becomes claustrophobic and cannot tolerate the mask.
- The patient develops acute gastric distention that is impairing respiratory effort
- The patient's blood pressure drops below 90 systolic at lowest PEEP setting
- The hospital cardio-pulmonary staff is prepared to immediately transfer the CPAP care.

### D. Post CPAP removal:

- Prepare for possible airway management with Bag Valve Mask (BVM) device assistance.
- Prepare for possible endotracheal intubation, then gastric decompression if needed.

### E. Transition at the Emergency Department:

- Sudden removal of CPAP on arrival at the ED is risky, so it should be continued until the patient clearly stabilized. It is important to give enough notification to the emergency

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department so that they can notify respiratory therapy. The in-hospital CPAP and BiPAP devices are more complicated and require more setup time. CPAP will drain the D sized cylinders more rapidly. Be prepared to access the wall mounted oxygen sources in the emergency department.

### F. Troubleshooting:

**Warning: Transport of patients with CPAP requires the certified Paramedic have a good working knowledge of the device's use and problem solution. Proper emergency back up equipment or other means of positive-pressure ventilation device must be immediately available during transport.**

Indication	Probable Cause	Solution
Low pressure; unable to maintain above 10 cm H <sub>2</sub> O and inadequate patient's respiratory response	Low supply of Oxygen	Always make sure an adequate supply of oxygen is available for patient use and transport
	Mask seal	Check for proper mask size and seal; especially at bridge of nose
	Leak in the breathing circuit	Disconnect the breathing circuit; assist oxygenation and ventilation as necessary
High pressure; gastric distention and inadequate respiratory response	Blocked airway; secretion or control module setting above 10 cm H <sub>2</sub> O	Position airway; consider suctioning and check the control module setting and adjust as required

Failure to respond to treatment of CPAP, your response should be to assist oxygenation and ventilation as necessary via other means, and intubation if warranted.

### XIII. Documentation

- A. Circumstances contributing to the decision for using CPAP.
- B. Procedure, patient assessment and outcome



## **Module Two**

### **I. Psychomotor Skills**

- A. Given the equipment to be used, the student will practice the proper technique for using Continuous Positive Airway Pressure (CPAP)
- B. Given the equipment to be used, in a one on one situation, the instructor will guide the student to perform the skill to proficiency.
- C. In a one on one situation, the instructor will create a minimum of three scenarios which meet one or more of the following criteria:
  - 1. There is an indication for use of CPAP.
  - 2. The device fails to operate properly.
  - 3. How to troubleshoot the CPAP Device.

*Note: The student must identify each situation correctly and perform the indicated tasks appropriately.*

### **II. Written Evaluation**

Administer a written evaluation completed with 80% competency.

### **III. Psychomotor Skills Evaluation**

- A. Using the attached practical skills sheet evaluation, the student will correctly use the CPAP with 80% competency; no failure of critical criteria.
- B. When conducting the practical testing the following conditions must be maintained:
  - 1. The practical exam must be conducted in a testing environment. The students must understand that they are being evaluated. Corrective guidance during the evaluation is not permitted.
  - 2. The evaluator must not reveal the specific criteria for failure.
  - 3. The student will be allowed three (3) attempts to perform the practical skills for evaluation of the utilization of Continuous Positive Airway Pressure (CPAP) with 80% competency; no failure of critical criteria.
  - 4. Students who fail will go through another training session and or a remediation process.

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Proposed Skills Evaluation**

Student's Name: \_\_\_\_\_

Date: \_\_\_\_\_ Attempt# \_\_\_\_\_

Evaluator: \_\_\_\_\_

Criteria	Points Possible	Points Attained
Demonstrated universal Body Substance Isolation techniques	1	
<b>Identifies need for the procedure:</b>	2	
Identifies the equipment required for the procedure	1	
<b>Procedure:</b>		
Connect Device to portable and house oxygen systems	2	
Connect the disposable circuit to the proper mask and demonstrate the technique of connecting to the Device	2	
Demonstrate coaching of the patient on the purpose and technique of CPAP and the Device	2	
Demonstrate properly titrating CPAP pressure to the desired levels using the Device	2	
Demonstrate proper placement of the headstrap to the mask and securing the mask to the patient	2	
Demonstrate setting up an in-line nebulizer and to the Device and Filter if applicable.	2	
Documents the procedure on an encounter form	1	
Total	17	

**Critical Criteria**

(Failure to meet any of the critical criteria constitutes failure. The student must be remediated prior to retesting.) The student has three (3) opportunities to successfully complete the test. If a student fails to achieve a passing grade after three (3) opportunities, the student must repeat the entire course.

- \_\_\_\_ Fails to properly demonstrate Body Substance Isolation procedures.
- \_\_\_\_ Fails to check CPAP for oxygen flow.
- \_\_\_\_ Fails to start PEEP and 5 cm H<sub>2</sub>O and titrate to a maximum of 10 as needed
- \_\_\_\_ Fails to identify corrective action for each recognized problem (i.e. air leak, hypotension, change in patient's LOC, airway compromise)